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Ashcroft's Improved Low Water Detector.

The philanthropist who, like a Peabody, gives of the surplus wealth he has to improve the condition of the poor, is deserving of all praise, and the honor and renown all such public benefactors enjoy for such praiseworthy acts of benificence is just and proper. Such deeds bring forth the natural expression of an appreciative public, and a grateful people benefitted; and nothing is more beautiful than true gratitude—the spontaneous outpouring of a sympathetic and a thankful heart.

If the man who gives of his substance to relieve the needy and distressed is worthy of such commendation, how much less worthy is the man who with mind controls matter, and by laborious scientific research and experiment, develops a principle in natural science, whereby thousands of lives and millions of property are annually saved?

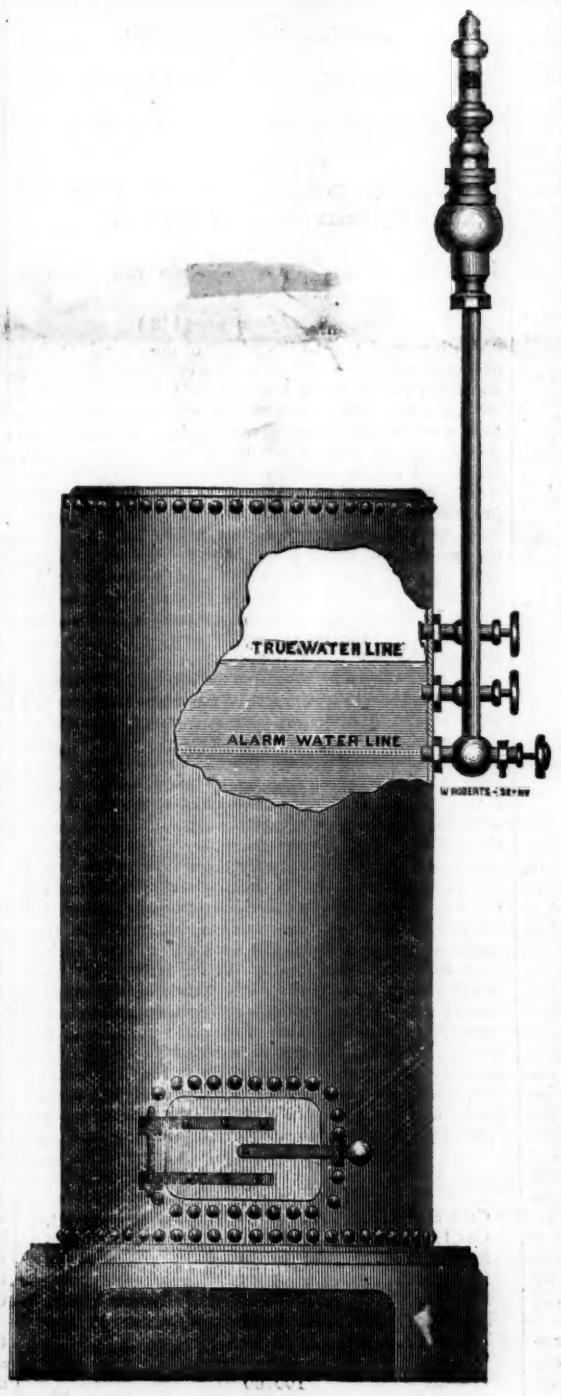
The invention illustrated herewith is of this nature. It is a simple, but an effectual appliance to any steam boiler, whereby it gives timely warning of any danger of explosion, by any neglect or accident, whereby the water becomes dangerously low. It is a silent but infallible, and ever watchful guardian until danger threatens, when it suddenly becomes a monitor, and sends forth its powerful note of alarm, so that the impending calamity may be averted. Such is "Ashcroft's Low Water Detector."

It consists of an upright tube of the proper dimensions, attached to the boiler, in the place of the lower gauge cock, as fully shown in the engraving. This pipe is provided with a plug, or a disc, of fusable metal or alloy in its upper part, and also a powerful steam whistle.

Its action is as follows: After the boiler has been filled to the water line and put in operation, the pressure of the steam forces the water into the pipe, and bulb or air chamber, in its upper end. As there can be no circulation in the pipe as long as the lower end of it is under the water line, the *fusable disc* will remain solid; but when the water in the boiler evaporates below the end of the pipe to the "alarm water line," then the water in it falls of its own weight into the boiler, and steam at once takes its place, melts the plug, and notice of *low water* is given by the sounding of the whistle.

This instrument works solely upon the natural laws of gravitation and heat. It has no springs, floats, or other mechanical apparatus to get out of order, and does not depend upon the uncertain expansion or contraction of metals.

The object of the detector is not to relieve the engineer from care or responsibility, but to act as a vigilant watchman. If the attendant performs his duties faithfully, the detector remains at rest; but if the water in the boiler is allowed to fall below the alarm water line, every person in the vicinity will be notified of the fact.



If this simple instrument had been in use, the late terrible and heart-rending accident at the State Fair at Indianapolis, would not have happened. The distressing accident by the explosion of the boiler of the Steam Fire Engine at Chatham Square, not long since, could not have occurred, if this instrument had been in use. The same may be said of the recent destructive boiler explosion at Storm & Corsa's paper mill, at Catskill. In fact, we see almost daily, notices of accidents of this nature, attended with loss of life and property, which could be avoided by the use of this cheap and simple instrument.

Steam is an useful agent when under control; but becomes a savage monster of destruction otherwise. No boiler should be without this device, and no man can have a clear conscience who, from cupidity or indifference, neglects for a single day to provide any boiler he may have in use, with this life and property-saving instrument.

For further information apply to John Ashcroft, 50 and 52 John street, New York City. Railway and Engineers' supplies.

The Price of Gas in England.—The present price of gas per thousand feet is, in Leeds, 3s. 6d.; Bury, 3s. 4d.; Salford, 3s. 4d.; Manchester, 3s. 2d.; Ashton, 3s. 2d.: Sheffield-3s. 3d.; Liverpool United, 3s.; Dudley, 3s.; Stockport, 3s.; Carlisle, 3s.; Stalybridge, 3s.; Derby, 2s. 11d.; Warrington, 2s. 9d.; Plymouth, 2s. 9d.; Cardiff, 2s. 9d.; Birmingham and Staffordshire, 2s. 6d.; Newcastle-on-Tyne, 2s. 6d; and Walsall, 2s. 4d. Not only have the Manchester people the advantage of cheap gas, but what is more, and what the Londoners with their high-priced gas have not, the Manchester gas consumers have gas that is good as well as cheap; and still more than all, the Manchester gas yields to the corporation, who provide it and of course to the people, handsome profits, which have been laid out in reducing local taxation, and carrying out city improvements.—*London Builder.*

There are 22,000 barrels of oil at Burning Springs, West Virginia, ready for shipment on the first rise in the Little Kanawha River.

Chemical Repertory.--No. 20.

DECEMBER 16, 1869.

Editorial.

SOLAR CHEMISTRY.

In No. 18 of the REPERTORY, November 16th, reference was made to a recent extraordinary reclamation of priority, by FIRMIN ANGELOT, of origination of the views now in wide acceptation, regarding the chemical constitution of the Sun; views that have been well expressed by STERRY HUNT (who attributes them to another eminent Frenchman, FAYE), in a passage which I have already copied, a year since (see this Journal of December 2, 1868, page 164), but which in this connection will bear repetition in part:

"The sun is to be conceived as an immense mass of intensely heated gaseous and dissociated matter, so condensed, however, that notwithstanding its excessive temperature, it has a specific gravity not much below that of water. * * * * The radiation of heat, going on from the surface of such an intensely heated mass of uncombined gases, will produce a superficial cooling, which will permit the combination of certain elements and the production of solid or liquid particles, which, suspended in the still dissociated vapors, become intensely luminous and form the solar photosphere. The condensed particles, carried down into the intensely heated mass, meet with a heat of dissociation; so the process of combination at the surface is incessantly renewed."

The passage now exhumed by ANGELOT from a French Journal of 1841, five years previous even to GROVE's initial discovery of the decomposition of water by heat alone, since named by DEVILLE "dissociation," is as follows; starting, as he says, with our knowledge of "the identity of composition of all the bodies of the solar system, as demonstrated by aerolites," he now recalls that he speaks of "the importance of masses of water at the surface of the Sun, whose existence we are authorized to admit analogically from those which cover three-fourths of our own globe"; and seeks "to establish by various modes of induction that the *alternate decomposition and recomposition of these masses of water* should explain all the phenomena we see in the solar atmosphere. The liquid or solid surface of the solar globe, endowed with an enormous temperature, decomposes the water that forms the greater part of its atmosphere. The hydrogen and oxygen, thus disunited and superheated, rise to the higher parts of this atmosphere, where a certain abasement of temperature permits them to combine anew, to redescend and disunite again, and this game of *va-et-vient* (go and come), of alternate decomposition and recomposition of water, furnishes indefinitely the same elements to this immense conflagration, which can have no ending but the refrigeration of the surface of the solar globe to a sufficiently low degree."

Then, would I add, shall the grand vision of the grand poet CAMPBELL come to pass:

> "We are twins in death, proud Sun,
> Thy face is cold, thy race is run,
> 'Tis Mercy bids thee go,
> For thou ten thousand thousand years
> Hast watched the tide of human tears,
> That shall no longer flow."

Nor is the poet unreasonably poetical in the immensity of his imaginary interval of time.

The communication of ELIE DE BEAUMONT to the French Academy, last February, setting forth the above, created an earnest discussion between himself, FAYE, and CHARLES ST.-CLAIRE DEVILLE, which would be highly interesting and instructive could we present it in full. Room, however, can be spared for a few points only. DE BEAUMONT alluded to SECCHI's division of the stars into three groups (see the REPERTORY of Jan. 16, 1869) of which the third and largest emit light like our sun, and to his further observation that the light of the red stars, of the second group (as *alpha* of Orion, etc.) is like that from a Bessemer steel furnace, also to hisd iscovery of rays pertaining to watery vapor in our sun; recalls the Cartesian hypothesis of the Earth being an *extinct sun*, and asks whether the differen groups of suns are not bodies in different stages of this burning process, in one of which they emit the rays of burning metals, afterward of burning hydrogen, and so on. He expresses his admiration of the genius which led M. ANGELOT, so many years before the recognition of the general fact of the decomposition of bodies into their elements by heat alone, to enunciate the above remarkable hypothesis, and concludes by favoring the idea that the surface of our terrestrial globe has been formed by combustion.

FAYE takes occasion to reiterate intimations expressed by him on previous occasions, that too much relative importance has been assigned to the recent achievements of the new instrument, the Spectroscope, in forgetfulness that our older instruments of investigation, the Telescope, Polariscope, etc., have already previously led us to satisfactory solutions of these solar problems; and refers to the capital discovery long since made by the Polariscope, that sunlight is not from a gas like hydrogen, but from solid or liquid bodies, suspended doubtless as clouds, in the photosphere.

CH. ST.-C. DEVILLE deems this polariscopic fact not at all at variance with the geogonic views adopted by DE BEAUMONT; inclining, himself, to the view that the solar hydrogen proceeds from the decomposition of pre-existent watery vapor by metals. He claims that in the early history of the primeval earth, we have evidence that oxidations occurred through the agency of water rather than of free oxygen. The hydrogen of the solar atmosphere forms the medium in which the incandescent clouds float. He appeals to the votaries of the three great Sciences—Astronomy, Geology and Chemistry, to work more in conjunction with each other.

In our AMERICAN ASSOCIATION some begin to realize the disadvantages of the old-established sectional divisions, in isolating from each other studies which will not stay divorced. For example, what place do we provide for *Chemical Geology?* So many of our eminent American geologists have disregarded and continue still to disregard the laboratory, as a sphere of geological labor, that Geology has been cast by us wholly into the lap of Natural History; and this which—though the offspring of two of the youngest of the Sciences, is destined to a Titanic caree—rfinds as yet no place for the sole of its foot. It would seem that some French scientists are beginning to awaken to similar failings and drawbacks in their own stereotyped organizations. Enough of this though for the moment.—H. W.

American Chemical News.

ORIGINAL COMMUNICATIONS.

STUDIES IN CHEMICAL GEOGONY.

IN THREE PARTS.

[Read at the Salem Meeting of the AM. ASSOCIATION, Aug. 1869.]

By HENRY WURTZ, of New York.

I. ON THE PROZOIC ATMOSPHERE, AND THE OCEAN OF THE ZOIC DAWN.

(*Continued from page* 148.)

With regard now to the metals of the Prozoic Ocean, or the bases with which its acids were combined; ferric and other oxides of the heavy metals, as I have shown, were among these, but never of course formed more than a minor percentage of the whole. One consideration is salient here, which is insisted on by STERRY HUNT, and scarce admits of a doubt; that the *characteristic* constituent of our Ocean, *sea-salt*, was originally present in far smaller proportion than now, and that it has been, at least in great part, a gradual product of the reaction of other pre-existent chlorides with the carbonate of soda that is continually carried in by rivers. It is thus that the carbonate of lime of sea-shells is supplied. Carbonate of potash is also thus carried in, but the potash would appear to have been eliminated again in insoluble forms, such as *glauconite*; while we know of no provision for removal of the soda. What were these pre-existent chlorides? Here is a point where, in our present condition of knowledge, there can be little but speculation; and where the great field for future investigation lies. There has already been much discussion as to the questions whether *chloride of aluminum* was present or not (to the affirmative of which I incline); whether the amounts of the chlorides of *calcium* and magnesium, or of either of them, were much greater formerly than now (of which I should incline to maintain the negative); which of the bases of the latter two chlorides predominated in the older Ocean, and so on. STERRY HUNT at one time made the suggestion that the waters of mineral springs from Silurian rocks, largely impregnated with these two chlorides, may be the fossil waters of the Silurian Ocean; but it seems probable rather that these are bitterns from the evaporation of enclosed portions of this Ocean. C. A. GOESSMANN, in a valuable paper, in the *American Journal of Science*, July, 1867, gives us a comparison between STERRY HUNT's analysis of a salt spring and his own of a Syracuse bittern, which has "practically ceased to evaporate" in the open air

	(GOESSMANN.)	Salt spring from near Bay of Quinte (T. S. HUNT).
CaO, SO^3	0.26	undet.
Ca Cl	10.47	9.205
Mg Cl	10.50	9.484
K Cl	3.38	
K Br	0.45	NaBr undet.
Na Cl	8 75	17.400
Water	66.19	
	100.00	

GOESSMANN argues that this resemblance shows the probability that such mineral waters "originate from mother-liquors or bitterns of the saline residue of marine evaporation of the Silurian age."

In the same paper, GOESSMANN, after referring to the views of KARSTEN, upon saline springs, as published by him in 1847, that these springs originate usually from rock-salt of Primitive (volcanic) origin, and are modified in composition by subsequent chemical action upon strata through which they effect their exudation; and that therefore the presence of chloride of calcium, with other compounds, was but accidental, says: that the presence of this chloride has since been recognized "as especially characteristic of the salt deposits of ante-tertiary date. Consequently these have been considered as a product of the constant admixture of the oceanic waters of preceding geological periods; while on the other hand its absence in our present Ocean and in most salt deposits of a more recent date, is an established fact." He doubts not that the composition of the Ocean has changed and is now changing, yet he asserts "that our ideas concerning the main features of the Primitive or Silurian Oceans are still vague, and especially so upon this one point" (*i. e.* the presence or absence of chloride of calcium).

In connection with these questions, it has occurred to me that EBELMEN's results (*Annales des Mines* [4], xii, 67) may have importance. He there shows that in the alteration and subaerial erosion of trap, 5-6ths of the lime, while not more than one-third of the magnesia and but half the alkalies, are lost. It is to be remembered that in our present Ocean the total lime is but about one-third of the total magnesia.

Deferring for the present some views of my own upon these points, I shall close this chapter with a brief remark upon another important element entering into these great and complex problems.

To a superficial observer it might appear that, as the Ocean continually receives mineral matter in solution, and continually evaporates, it should become more and more charged with each of its dissolved constituents. This view, however, requires great modification, and here we find one of the grandest illustrations of the governing influence of Life, according to my proposition at the outset of this paper. For example, as stated above, the continuous predominance of magnesia over lime in our present Ocean, notwithstanding that rivers constantly pour in several times more of the latter than of the former. Through Zoic influences numerous other important constituents of the oceanic waters are eliminated and converted into permanently solid and insoluble forms, and thus constantly removed, in many cases quite as fast as they are supplied. Among these may be mentioned *carbonic acid, sulphur, phosphorus, potash, iron* and *silica*.

II. ZOIC HISTORY; FROM A CHEMICAL VIEW-POINT.

This chapter of the memoir relates to the demonstration, illustration, and general elucidation of my proposition of the ruling influence of LIFE in the Chemical History of Geological development. The subject is so vast that I have judged it proper not to make a vain attempt to condense it into a compass appropriate to the present occasion. DANA purposely omits this and its related subjects from his great work, on account of the "large amount of space" that would be required (DANA's Geology, p. 604).

I will but say that the general scope of my attempt is to show that a consistent theoretical scheme of Zoic development, including the *breaks* in Zoic history, and other readings of the geologic revelation, may be based on the study of the progressive (direct and indirect) influences of Life itself on the elements of the Earth, and on the forces that move and transform them. I claim that we have here an almost new and unexplored field of investigation, the working of which is to yield us results quite as positive, valuable, and wonderful as those of the study of fossils, and that the two studies will be found supplementary and altogether essential to each other. I start of course with my primary postulate, offered in the preceding chapter, that Life found the Earth in a condition of completed combustion, and that it has been the sole Oxygen-Maker, and Deoxidizer. Herein Life has itself done *no work*, it has but directed or governed the working forces of the Solar Emanation, in reversing the opposing influences of chemical affinity. It is a master, not a laborer. In my philosophy I regard neither vitality nor affinity as forces capable of transforming matter. They are both rulers of the forces that transform matter. Their reigns are antagonistic and alternating with each other. This is a subject which I propose to treat elsewhere.

In gradually impregnating the atmosphere with active oxygen, Life has profoundly altered, in an infinity of ways, the whole chemical status of the earth's crust, and, moreover, by substitution of oxygen for the pre-existing carbonic acid, the weight and density (though not the volume) and a multitude of other physical conditions of the atmosphere, have been changed.

As examples, I shall select, almost at random, one or two of the striking geological views which grow out of such chemical considerations. As to the mode of formation of *petroleum*, many speculations have been offer-

ed; but the following *fact* is here pointed out for the first time. The petroleum-bearing strata antecede the larger mass of the Carboniferous. It is clear therefore that the oxygen corresponding to the carbon, and part of the hydrogen, of the huge masses of coal of subsequent Carboniferous strata, as well as of the fossil matters since deposited (the Tertiary lignites for example), and of all now existing vegetation, had not then as yet passed into the atmosphere. In an atmosphere so poor (comparatively) in oxygen, could decay and eremacausis proceed with the rapidity and intensity of our day? Would they not rather be necessarily so slow and imperfect that liquid products would be formed instead of gaseous? Of course the greater content of carbonic acid in the atmosphere during the days of Petroleum-Genesis (represented now by not only all the fossil matter, but by all the limestones, dolomites and chalybites since formed) may have contributed its modifying influence.

[To be continued.]

NOTE ON A NEW EXPERIMENT IN "DISSOCIATION."

By Prof. B. Silliman.

[Read by Prof. H. Wurtz, to the N. Y. Lyceum of Natural History, December 13, 1869.

[In very recent correspondence with Prof. Silliman, he has informed me of what is, so far as I know, an an entirely new and very striking observation of his, upon the direct decomposition of water by intense heat alone, the grand fact first discovered py Grove in 1861, a discovery out of which the now mooted doctrine of *dissociation* has arisen. With his consent, given at my request, I present it.—H. W.]

Professor Silliman says (December 1, 1869):

"I have made an interesting observation on the dissociation of hydrogen and oxygen, in connection with which I propose to make some eudiometrical determinations. Having lately occasion to use a powerful combination of Bunsen cells, Dr. Barker and I repeated Berthelot's synthesis of acetylene* by forming the voltaic arc in an atmosphere of hydrogen, when the vapor of carbon unites with (burns in) hydrogen, giving acetylene, which, led into a solution of argentic nitrate in ammonia gives the silver-salt analogous to the cuprous compound of acetylene when ammoniacal cuprous chloride is used.

"But I afterwards found that when the arc is formed in *pure water*, only a small part of the atmosphere of carbon vapor burns in the oxygen, forming carbonic acid, while about 90 per cent. of it appears as oxygen mingled with hydrogen, and undoubtedly also with acetylene. This phenomena is not to be confounded with *electrolysis*, which in pure water takes place very feebly even with 50 couples, while as soon as contact of the carbon electrodes is made, electrolysis ceases, and torrents of gas are evolved, which come only from the dissociation of the elements of water at the enormous heat of the voltaic arc. I shall make a short paper of this for our January number. It is likely that a portion of acetylene is synthetically formed here also, as all the conditions are present, and if an oxide of carbon (CO^2) is formed, why not a hydruret also?

The presence of a large volume of oxygen was clearly shown through its absorption by alkaline pyrogalline, while there is little doubt of the simultaneous production of acetylene and of marsh gas.

The producing of the voltaic arc beneath the surface of various liquids is a very old class experiment which has been seen in our laboratory at Yale, since the day of Dr. Hare's Deflagrator, in 1821.† But often as it has fallen under my notice, it never before occurred to me that its most important scientific import had been disregarded.

[Grove's original experiment consisted in heating to intensity in a voltaic circuit, a platinum wire immersed in water; also, in suddenly immersing in water platinum previously brought to intense incandescence by Hare's blowpipe. He found that palladium and some other *metals* also evolved explosive gas under the same circumstances, but his experiments with silica and other *non metallic* bodies were not considered conclusive, and we hence have in Silliman's new experiment a new phase of the phenomenon, endowed with special interest, inasmuch as here it is evident that it is at least no metallic body which does the work. The questions arise, however, whether it is the *solid* incandescent carbon of the poles (like the solid platinum in Grove's experiment) which works the decomposition of the steam, or the carbon (supposed vaporous, and probably actually so) which is conveyed by the flame from positive pole to negative, or again the heat of the naked flame itself, or all of these? It occurs to me that the question of the dissociating power of *flame*, apart from any solidity or electric conducting power of the heated body, might be determined, could we devise a flame which would burn under water, while containing no oxygen; a flame of hydrogen and chlorine, for example. If the gaseous products contained free oxygen, we should have here a crucial experiment. I propose to make this experiment at an early day. Prof. S.'s experiment, I would point out, indicates clearly the conclusion that in the supposed electrolysis of pure water by transmitting through it a stream of sparks of frictional electricity, or even of Prof Henry's intensity sparks (from an induction apparatus), the apparent electrolysis may really be, either partially or even wholly, simple decomposition by the heat of the spark.

H. W.]

* *An. de Chimie et de Phys.* (3) lxvii, 67.
† *Am. Journal of Science* (1st Series), vol. iv, p. 202.

ERRATA.

In our last issue, in the article by Prof. Silliman, under the head "American Chemical News," a sentence was omitted, which we must correct. In the 2d paragraph, 2d line, it should read as follows, "ard argand burner at the rate of 5 cubic feet per hour without smoking, is consumed at the rate of 3½ cubic feet to the hour."

Professor Henry Wurtz:

Dear Sir: I wish in the outset, to express my sincere regret that anything should have found its way into my previous communication, which could have been construed by Dr. Van der Weyde into a personal reflection upon himself. Certainly no such reflection was intended. On the contrary, I am well aware of the Doctor's extensive learning, and great activity of mind in scientific matters.

I made reference, it is true, to a class of minds among whom I fear we must include some of the ablest experimenters in natural science, who are unable or unwilling to admit any thing which is not confirmed by the direct evidence of the senses. To such minds the doctrine of independent force seems absurd, and for the same reason that gravitation in opposite directions seemed absurd to my friend the miller, and that the Copernican theory of the earth's motion around the sun was not generally received by cotemporary astronomers, namely, because such doctrines did not appear to accord with visual testimony. If, however, a weight of evidence and reasoning like that adduced to prove the rotation and revolution of the earth, can be presented in support of the independent existence of force, the latter doctrine will ultimately be as unreservedly and generally adopted as the former.

I will first examine the Doctor's arguments against this doctrine, and then briefly state those which have occurred to me in its favor.

In the first place I must dissent from the Doctor when he calls it an "old notion." I believe the first definite statement of it to have been made by myself in 1864. (See *Am. Jour. of Sci.* vol. xl, p. 254.)

The notion that matter is nothing but "centres of force" is an entirely different one from mine, which is that force and matter are two distinct entities; that matter is susceptible of motion but incapable of moving by any property of its own, and that force is that which *when associated with matter* causes it to move, the direction being that of the force, and the velocity being in proportion to the amount of force associated. Since force occupies all space, and in all directions, a single atom would be urged in every possible direction, were it not that opposite forces dissociate each other, or, what amounts practically to the same thing, the atoms may, by the law of composition of forces, be supposed to have a compound motion in every direction, the resultant being zero.

But we may suppose that each atom when paired with each other atom in the Universe, intercepts a portion of the force, whose direction is towards the other atom, from acting upon the other atom, hence a mutual tendency of the atoms towards each other. This is the simple explanation of gravitation.

If this theory has been advanced by any one previously to myself, I will thank the Doctor to indicate when and where.

I must also deny the charge made against me of fighting against the theory of the Conservation of Force. This charge is exactly the reverse of the truth, the fact being that I am endeavoring to sustain this theory, of which I am as fully convinced as of any scientific truth whatever. What I contend is that the recognition of force as an independent entity is the *only way in which it is possible to maintain the Conservation theory.*

It will be seen that the Doctor admits that "potential energy or latent force includes the idea of matter in which force is stored up. In these terms therefore the necessity of associating matter with motion is evident, *even if the motion is to take place only in the future.*"

I call attention to the sentence in this quotation which I have italicised, and ask how it is possible for force ("matter in motion") to be conserved, if a portion of it ceases to exist in the present, and is to be found "only in the future"? It is not I, but the Doctor, therefore, who fights the Conservation theory, and if, as he says, the definition of force as matter in motion and that mode of presenting the theory of the Conservation of Force, which consists in stating that the sum of actual motion in the Universe is unchangeable in quantity, must stand or fall together, then he has overthrown both, by the admission that a portion of this unchangeable amount can exist only in the future. A conservation which depends for its maintenance upon restorations of its losses by accessions to be received in the future, is no conservation at all. As well might the speculator or gambler, who alternately loses and gains in his operations, argue that his wealth remains unchanged, because his losses of to-day will be made up by gains to-morrow.

Moreover, no definition is precise or accurate, which cannot always be substituted in the place of the word whose meaning it defines. It is very plain that "matter in motion" cannot be substituted for "potential energy" (and it seems, after all, that the Doctor has adopted this conception under the name of "latent force") which acts not in the present but "only in the future." Indeed, he expressly admits that the expression "matter in motion," cannot always be substituted for the word force. I think I am fully justified therefore in my indication of this expression, as an example of a want of precision in definition.

I am next accused of "taking mere words for the base of reasoning; words which when disociated from their original meaning, convey only an obscure foggy meaning." This refers, of course, to the word force, as understood and defined by me, namely, that which produces motion, and to my conception of its existence as an independent cause. I confess I can see no cogency in the Dr.'s attempt to show an analogy between this and imaginary quantities in mathematics. Such a comparison is a simple begging of the question; it contains no argument. Nor do I understand the Doctor's remark, that my conclusion "is equivalent to the dissociation of motion from matter, as if there could possibly be motion, or even an attempt at motion, or tendency to motion, when there is nothing left to be moved." Does he mean by this (and I can see no other meaning), that if motion is attributed to a cause independent of matter, then matter must in consequence cease to exist? Where is the logic of this argument?

A cause is that which produces change. Conversely every change must have a cause. Motion is a continued change of position,* hence motion must have a cause. No one will claim that matter can set itself in motion, and if it be said that the motion of one body, by being expended or destroyed, gives rise to motion in another body (which is not true, as I have shown, and as Dr. V. admits) we do not then arrive at the *cause* of the motion, for the moving body continually experiences change, hence there must exist a cause therefor, which is continually active. Surely this active cause which we call force is not a "mere word" without a corresponding reality, whatever we may say of the obscurity in which the ultimate nature of force is involved. It is quite certain that *something* causes matter to move, and that this something, while it is recognizable and measurable only by its effects, is indestructible in quantity. This is all we know concerning force, and doubtless all that is needful for us to know.

The attempt to stigmatize this recognition of an independent cause of motion, by asserting its identity with "spiritual agency" is simply absurd. Undoubtedly the prime source of all power is the Divine Author of the Universe, whose existence none can doubt, ex-

* I would like to have Dr. V. define motion, fully and clearly stating if he can, its nature and cause, as suggested in your editorial remarks on page 104.

cepting perhaps a small number of those who believe nothing that they do not perceive by their physical senses, and who admit the existence of nothing but matter.

The quotation from TYNDALL presents in a lucid manner the similarity between gravity and chemical attraction, and I go still further to say that both are the exhibitions of one Universal Force, the same which causes gravitation. Thus, chemical attraction is the gravitation of atoms to form molecules and cohesion, or crystalline attractions, the gravitation of the molecules into the solid condition of matter*

The only answer, however, which is given in this quotation to the questions of Prof. NORTON and Prof. HENRY, and the true one is, that the energy of motion is converted into "potential energy (that is, restored to its independent condition in space), and that this potential energy or dissociated force, may under favorable circumstances again become associated with matter to constitute actual energy of motion "in the future."

Enough has been said, I think, to show the inaccuracy as a definition, and the untenability as a hypothesis, of the statement that force is "nothing but matter in motion." Sir JOHN HERSCHEL, in a paper on the "Origin of Force,"† in which he sustains with lucid and cogent arguments the idea that force is a real agent, acting across spaces which are devoid of matter, speaks of the hypothesis that all new motions are merely transfers of old motions by the impacts or collisions of matter against matter, as follows:

"This doctrine goes to resolve the entire assemblage of natural phenomena, into a mere knocking about of an inconceivable number of inconceivably minute bil liard balls (or cubes or tetrahedrons, if that be preferred) which once set in motion, and abandoned to their mutual encounter and impact, work out the totality of natural phenomena."

Then he goes on to demonstrate by the laws of mechanics that the realization of such a supposition would lead to the speedy dying away of all relative motion, and the reduction of the Universe either to a single block of matter moving uniformly on, for ever, in one direction, without relative motion of its parts; or else in the dispersion into space, and absolute final dissociation of its molecules.

Probably a majority of the scientific men of the present day regard the forces of nature as attractive and repulsive, and suppose that while these forces are, in one sense, inherent to matter, they yet act across vacant spaces.

According to the theory of BOSCOVICH, which apparently forms the basis of most treatises on mechanics, each atom in the Universe is possessed with two kinds of force, one attractive and the other repulsive. These forces are exerted upon other atoms with an intensity varying with the distance, but in accordance with different laws, so that the preponderance between the two forces changes, with several alternations, at different distances, inappreciable in their minuteness, commencing with a repulsion of an infinite intensity (impenetrability) at an infinitely small distance, and finally merging at appreciable distances into a resultant attraction, which diminishes with the square of the distance. This final resultant is known as gravity. while the intermediate conditions range from impenetrability through chemical attraction, crystalline force, cohesion, gaseous repulsion, etc., to the gravitation of appreciably separated atoms or masses.

This theory presents the idea that all motion is produced, not by physical contacts, but by the exercise of *force*, which is an active reality and not a mere word." And since it acts across vacant spaces it must in so doing "occupy space," and therefore exist in an independent condition; at least so far as location is concerned, unless we adopt the illogically metaphysical notion that since these forces are the inherent property of matter, therefore matter itself occupies all the space where its force is exerted, that is, every atom of matter fills the entire Universe.

Before the modern discoveries leading to the dynamical theory of heat, and revealing dynamical relations of unexpected magnitude between the atoms of all substances, in virtue of which they are doubtless moving among each other with enormous velocities, the atomic theory of BOSCOVICH, like the astronomical theory of PTOLEMY, with its bewildering complications of cycloidal and epicycloidal orbits, accounted for, or rather formulated the observed phenomena. But in the light of present knowledge, a new theory which will include the dynamical theory of heat, its application to the dynamical theory of gases, etc., seems indispensable.

I have made some rude attempts to frame the outlines of such a theory.

The first general outline was sketched in 1864, and briefly described in the *Am. Jour. of Sci.* as already cited (Vol. xl., p. 254.) Since then it has been partially developed and applied to Atomic Motions, in papers read before the American Institute in New York, and the AMERICAN ASSOCIATION at the Chicago and Salem meetings. In that portion of the hypothesis relating to the constitution of matter, a reduction of the usual number of preliminary assumptions to a minimum was attempted. Accordingly the only property attributed to matter, besides quantity, is mobility when associated with force. The usual assumptions that matter possesses among its primary properties hardness, solidity, impenetrability, elasticity, etc., are not admitted. Such properties as inherent attractions and repulsions are, of course, also discarded.

The theory of gravitation, as propounded and demonstrated by NEWTON, by no means includes the hypothesis that bodies or atoms *attract* each other. It only sets forth that all matter *tends towards* all other matter with a force whose intensity is directly as the mass, and inversely as the square of the distance. The idea of attraction as commonly understood is, on the contrary, expressly disclaimed by NEWTON, in one of his letters, as follows:

"That gravity should be innate, inherent, and essential to matter, so that one body may act upon another at a distance, through a *vacuum*, without the mediation of any thing else, by and through which their action and force may be conveyed from one to another, is to me so great an absurdity, that I believe no man who has in philosophical matters a competent faculty of thinking, can ever fall into it. Gravity must be caused by an agent, acting constantly according to certain laws; but whether this agent be material or immaterial, I have left to the consideration of my reader."

FARADAY has clearly shown that the idea of inherent attraction is fatal to that of Conservation of Force. Indeed, it is in consequence of attributing motions to attractive and repulsive forces, that it becomes necessary to interpolate the idea of potential energy, an "imaginary quantity," to maintain the Conservation theory.

Mr. JAMES CROLL, a distinguished scientific writer, in an able paper published in December, 1857, (*Phil. Mag.* xxxiv, 456) comes to a conclusion which he thinks is indicated in previous discussions by FARADAY, WATERSTON, and others, that "gravity is a force pervading space external to bodies, and that on their mutual approach this force is not increased as is generally supposed; the bodies merely pass into a place where the force exists with greater intensity; for in such a case the intensity of the force, in the space external to any body, is inversely as the square of the distance, from the convergence of these lines of force. As the stone recedes from the earth, its *vis viva* is transferred to space and exists there as gravity. When the stone approaches to the earth, the force existing in space is transferred back to the body, and appears again as *vis viva*." He also quotes from WATERSTON as follows:

"The integral gravitation is a function of space."

"Each element of radial distance has associated with it a fixed element of mechanical force, to be given or taken from all bodies traversing it."

To sum up:

The reasons for accepting the doctrine of a Universal Force, external to matter, and in a state of dissociation from, as well as association with it, are briefly;

First.—It accounts for gravitation without involving the violently improbable ideas that every atom has, bottled up within it, as it were, a force which continually varies, according to circumstances, from an inappreciably minute up to an infinitely powerful intensity; that it is enabled, by an inconceivable sort of discrimination, to act in the exact direction of another atom, at a distance, across a vacant space; and that its intensity is not diminished, but on the contrary increased, by being expended.

Second.—It teaches that Force is an entity, and as such is indestructible and unchangeable in quantity; in other words, it teaches the true theory of the Conservation of Force.

Third.—It correlates gravity with all the other forces of nature, including those known as Molecular Forces, and traces them all to one Universal Force.

This correlation has been indicated by me in the papers read before the AMERICAN ASSOCIATION, in regard to heat, cohesion, etc., but owing to the length which my present paper has already attained, I must defer further remarks on the subject to a future communication.

H. F. WALLING.

LAFAYETTE COLLEGE, Easton, Pa., Nov. 20, 1869.

* My paper on "Elemental Fibres," which was read before the AMERICAN ASSOCIATION at their last meeting in Salem, is an attempt both to show the mode of this atomic gravitations and to account for its apparently enormous preponderance in intensity over the gravity of masses, under the supposition that all the atoms are placed at equal distances apart in a solid substance. In the wire models which I exhibited, a different arrangement was shown to exist. In these the atoms were supposed to have become arranged, under the law of gravitation, at extremely minute distances from each other, in very nearly continuous lines or "fibres," forming ring-shaped and interlined orbits in solid or crystalline bodies. The force which holds matter together and gives it rigidity of form is thus accounted for. Moreover, in connection with a purely dynamical theory of the constitution of matter. which supposes all the atoms of a body to be moving, relatively to each other, with enormously rapid velocities, we are enabled to account not only for the mechanical equivalent of heat, but for all the other repulsive forces of nature, including some of the so-called primary properties of matter, such as elasticity, impenetrability, etc., by attributing them to the centrifugal force or momentum of the moving atoms.

† Popular Lectures on Familiar Science, p.

A New and Economical Method

FOR EFFECTING THE EXTRICATION AND CONDENSATION OF AMMONIA FROM GAS LIQUOR

For Purposes of Cheap Carriage, and for Facilitating the Manufacture of Ammoniacal Salts.

[Read before the British Association, Exeter Meeting, Section C.]

By FREDRICK BRABY, F.G.S.

(Concluded from p. 149.)

The principles already indicated may, perhaps, be illustrated with advantage by a brief description of a working plan actually constructed at Deptford for the purpose of extracting ammonia. An excavation has been made in which is sunk a reservoir for containing the gas liquor, and having the following dimensions:—namely, 35 feet long, 4 feet wide, and 6 feet deep. The bottom is formed of 1 foot of concrete, two courses of brick, and of two courses of red flat tiles; the sides are of 14 inch brick-work, two courses with tiles in conjunction with concrete.

The wrought-iron still is set in brick-work, so that flame may play more than half round its external surface. It is 30 feet long by 6 feet in diameter. About 4000 gallons of gas liquor are pumped into it from the reservoir for the purpose of being operated upon.

Heat is applied by means of a fire underneath, but a coil of hot air or steam pipes placed in the interior of the still or boiler would be equally efficacious. Two cast-iron 3-inch air-pipes, which are attached to the ammonia generator, extend along its whole length, and are situated one on either side, and nearly at the bottom. They are perforated with holes increasing in size as they extend from the inlet. Into these pipes, and from them into the gas liquor, is driven atmospheric air by means of a pair of cast iron force pumps. These are 20 inches in diameter, 1 foot 8 inches stroke, with rods and slings, wrought-iron connecting rod and crank, and a cast-iron beam 6 feet long. On the entry of the streams of air they are caught and agitated by the 12 iron fans of a stirrer, making about 80 revolutions per minute.

The air, together with the lime and the various constituents of the gas lipuor (viz., water, ammonia, carbonic dioxide, sulphuretted hydrogen, sulpho-cyanides, etc.) are thus brought continuously into intimate contact. The air loaded with the volatile alkali which has become eliminated from the solution, passes upwards into the steam chest and through a branch pipe into the purifier or washer. This is a small wooden vessel of the capacity of 350 gallons, containing lime and being about one-third full of water. It has a tight head and a stout perforated elm false bottom, the holes being concentric and increasing in number and dimension as they radiate from the inlet, which is brought below the false bottom.

This purifying vessel is furnished with a small agitator having two blades, one revolving above the other below the false bottom. There are two trial or test taps at appropriate heights, to test for gas or for water, and there is also a pipe sealed at one end, rather less than half way from the bottom, for the purpose of leading away any excess of liquor that may accumulate, owing to the condensation of aqueous vapor which may pass over with the volatile alkali. There is a long straight tube or safety pipe from the washer, and the bent pipe from the ammonia generator is also provided with a safety valve and a vacuum valve. In the washer the ammonia is deprived of any remaining hydrosulphuric acid or other impurity that may have escaped, being fixed in the generator. About half a bushel of finely sifted slaked chalk lime is found to be a suitable charge for the washer, and when this becomes saturated or impure it is renewed by means of a pipe and tap placed at the bottom of the vessel. The washer being a close vessel soon becomes full of air and gas, which are forced by the pressure through a pipe opening into the top and leading to a coil or worm placed in a cold water cistern, and terminating in a close vessel about one-third full of pure cold water, which has been condensed from the waste from the engine. A portion of the ammonia becomes absorbed by the water, but the residue, together with all the air, after bubbling up through the liquid, is conducted by a bent pipe to nearly the bottom of a second similar receiver, and thence in the same way to a third, but which is opened at the top.

The air, having fulfilled its function, is now permitted to escape into the atmosphere, the whole of the ammonia having, however, been arrested.

This last receiver, instead of water, contains a strong solution of chloride of iron, which being denser and possessing a higher specific gravity than water, offers a greater pressure and resistance to the passage of the gas. The iron salt is, of course, decomposed, with formation of muriate of ammonia in solution, with deposition of a green mud containing sesquioxide of iron, which, after having been calcined, is found to constitute an excellent pigment for rough iron or wood-work.

After the whole of the ammonia has been extracted from the gas liquor, the contents of the still are run off into a draining pit, from which the clear solution finds its way into the sewers, and the solid inodorous lime compounds may be carted away.

This draining pit is constructed of 1¼ in chdeal boards together with sand and brick-work. It is 4 ft. 9 inches wide, 5 feet 4 inches deep, 10 feet long. There are fillets whereon to rest three perforated shelves or platforms. The bottom is formed of perforated deals with 6 inches of sand, also with gravel, and cement. There are channels and small drain pipes leading into a large central earthenware pipe, and from thence into a sewer. The sharp sand etc., under the perforated boards can be removed at will, and replaced by fresh materials whenever required.

Care must be taken that the large pipe from the boiler to the washer be sufficiently high to guard against any back pressure. The vacuum valve opens and admits air when the fire of the still is withdrawn and the steam becomes condensed.

In order to ascertain the exact state of the contents of the boiler at any required height, and to avoid tapping the upper portion of the boiler at too many places, the following simple contrivance is adopted;—There is one tap at the lower end, to which is attached a short pipe inside the still working easily on an elbow. To this pipe is connected a copper wire having its outlet just above the external surface of the boiler, and by which wire the short pipe may have its orifice presented at any required height, at which it is desired to ascertain the state of the contents of the vessel. For instance, supposing the fire to be withdrawn, and the agitators to be quiescent, if the end of the tube were pulled up by the wire and the tap opened, a clear liquid would issue, which could be tested in order to ascertain whether the whole of the ammoniacal gas had been removed. On the other hand, if the short tube were allowed to lay along the bottom of the still, the opened cock would allow the green sulphocalcareous mud to escape.

It is stated in Dr. Miller's "Elements of Chemistry" that at a temperature of 35°, water takes up about 1050 times its volume of ammonia; at 69°, 727 times, and at 78°, 586 times its volume. Water saturated with ammonia at 60° contains more than one-third of its weight of gas, increasing in bulk from 1·0 to 1·5, and becoming specifically lighter.

Hence the receiver should be not more than one-third or ¼ full of water to allow for the increase in bulk caused by the solution of the ammonia.

In July, 1867, valuable papers upon the utilisation of the waste products of the manufacture of coal gas were read before that important body, the British Association of Gas Managers, by two of our first authorities on this subject, Dr. Letheby and W. Esson, Esq. Dr. Letheby declares that it is so manifestly of the greatest importance that the liquor should be sent away to the gas works as strong as possible; it ought, in fact, never to be under 6° Twaddle, or of less than 12 ounces strength, and with proper condensation and judicious washing there should be from 29 to 30 gallons of such liquor produced from every ton of coals. The price in London is 2s. per butt, 8-oz., with an increase of 4d. per oz. on every additional ounce of acid strength. Below 3° of Twaddle or 5 ounces of acid it does not pay for working, whereas at 10° or 11° of Twaddle it is a valuable product. Both Dr. Letheby and Mr. Esson emphatically insist upon the importance of the strength o the ammoniacal liquor. So rapidly does the commercial value augment, in relation to its concentration that, whereas a butt of 108 gallons of gas liquor is worth 4s., the same quantity of caustic ammonia of specific gravity 0·902 is worth from £15 to £20. A lower strength of gas liquor than 6-ounces has not hitherto been thought worth working, but one advantage in Brady's system of extrication and concentration consists in the fact that a high strength is not indispensible. Even 2 ounces would in practice yield a profit.

As an evidence of the importance of an increased supply of ammonia and of its large demand, it may be mentioned that a firm with which the writer is connected recently offered 4s. per butt of 6 ounce liquor, and yet was unable to obtain a supply, showing that the value has doubled in the short space of two years. Mr. Esson describes an economical arrangement for the extrication of ammonia from gas liquor with the assistance of steam, and by an apparatus similar to a Coffey's still, but which is subject to the disadvantage that the noxious gas (sulphuretted hydrogen) is not simultaneously fixed or disposed of, and that at least 15 per cent of ammonia is left in the liquor, which has afterwards to undergo the supplementary process of distillation with lime. The present ordinary metbod of making liquor ammonia is, as far as I am acquainted, from sulphate or muriate of ammonia, which is itself obtained from gas water. By Brady's process, liquor ammonia may be obtained much more quickly and economically from gas liquor direct.

There are many gas works where ammoniacal salts are now manufactured; but it is suggested that, in new works, or at those where the gas liquor is not at present utilised, it would be preferable, in the event of the adoption of the principle herein advocated, that the ammonia, after concentration, should be sent to the sulphuric or muriatic acid works, rather than that the acids should be sent to the gas works. In metallurgy, it is found more advantageous to transport the calcined or partly prepared ores to the coal districts for smelting, rather than to take the fuel to the mines.

Barges fitted with tanks ordinarily employed in the conveyance of gas liquor contain fron 3000 to 8000 gallons. A land journev of 12 miles with two horses for a load of 500 gallons in a tank van now costs £1. By rail, the cost of freight is 1d. per ton per mile.

The advantages of the above described system may be summed up as effecting a considerable economy in labor, time, and occupation of plant, together with the facility of extricating the whole of the ammonia from the gas liquor in a pure condition. A manufactory, previously consuming 10,000 gallons of gas liquor per week, may now utilise 24,000 gallons, and at about half the expense of fuel of that formerly incurred.

The great interest of this subject in a chemical point of view, its high importance to the metallurgist and manufacturer, and the increasing value of ammonia to the farmer (with whom it is almost another name for fertility and abundance), must constitute my apology for having engaged so much valuable time in its consideration.

New Gas Works in Lawrence, Kansas.

[*From the Republican Journal.*]

We have written and said a good deal about the Lawrence Gas, Coal and Coke Company since its organization, and since operations have been commenced in the city, and nothing that we may say can advertise it better than the marvelous progress the building company have made, since operations for lighting the city have been commenced. From the time that the first shovel full of dirt was thrown at the foot of Henry street, on the 15th of September, to the present, work has been pushed forward with vigor and determination. No doubting, vascilating policy has been pursued by the company. They commenced work in earnest, and have worked earnestly ever since. Every citizen of Lawrence should feel proud of the energy with which everything has been carried on by our gas company, and we trust all citizens who can do so will second the efforts of this incorporation, by immediately putting in fixtures, and preparing to keep up with the new order of things and the progressive spirit of the age. The cost of coal oil, lamps, and chimneys, for some of our business houses, reaches as high as two hundred dollars per annum, to say nothing of the annoyance of cleaning lamps and chimneys, and having things smeared with oil generally, together with the additional fire risks attending the use of kerosene, which will very nearly amount to twenty-five per cent. more. A very little—probably not any more—cost would light the same building with gas, when we would not only have a neat, clean light, but one far more brilliant, and that would afford more general satisfaction. Our city gas works have been leased for a term of five years by the building contractors, the New York Gas Works Building Company. Of this company Mr. C. E. Gray, of Alliance, Ohio, is president and business manager, and Joseph G. E. Larned, of New York city, is secretary. Mr. Wellington Lee is engineer and superintendent of construction. He is a gentleman of energy and enterprise, and under his eye our works have been pushed forward successfully. Mr. Gray is also at present in the city, and with his personal aid to the superintendent, everything moves along in admirable order. Many persons inquire why the patent composition pipes for "mains" are used instead of iron. We have been assured that this pipe is preferable to iron. It is durable and not subject to expansion and contraction as iron pipes are, and consequently not so apt to leak. The mains are laid about three feet under ground, and when made tight, remain so, thus avoiding the continual digging up of streets and the annoyance of having dirt piled up and travel obstructed. Then they are much easier handled. Iron pipes now are made so thin and full of sand-holes, that it is very difficult to prevent their leakings, independent of the expansion and contraction.

As to what gas will be furnished at per thousand cubic feet, depends solely upon the number of consumers. The present winter coal will be very scarce, and consequently high. Even with these difficulties in the way, the price will not exceed five dollars to begin with, and from that it will decrease according to the increase in the number of the consumers and the supply of coal. It is the design of the company to furnish gas as cheap as it can be afforded, leaving future years and a greater demand to return a profit. We imagine that few business men will adhere to coal oil and lamps when they see their neighbors' stores brilliantly illuminated with gas. The contrast will be as great as that between a common tallow candle and a clear coal oil light.

The company will put service pipe, stop-cocks and and boxes to the curb without extra charge, although a charge is made for such service in most of the Western towns. In this there is an exhibition of great liberality and a manifest disposition on the part of the gas company to get all of our people to use illuminating gas, for it is a saving of from twenty to twenty-five dollars to consumers in proportion to the amount of light furnished. Messrs. H. J. Miller & Co., of Leavenworth, have opened a branch store in this city, at 66 Massachusetts street, for the purpose of piping buildings and furnishing fixtures. The gas company have made arrangements with this house to put in fixtures at the lowest possible rates, so as to encourage consumption.

Mr. Geo. A. Farwell, late of the Detroit (Mich.) gas works, who has lately been appointed superintendent of the company, has come to our city within the past week to enter upon the discharge of his duties. He comes with a good record as a thorough and energetic business man. He has the highest testimonials as to integrity and business qualifications of every officer of the Detroit gas company, and also from prominent business men and citizens of that city. Mr. Farwell is a gentleman who will take pains to render all business transactions connected with his office pleasant, and give our people any information that will enable them to understand the meters, or anything else connected with the works.

Correspondence.

[Correspondents in all cases should sign their communications with their names and address in full, not necessarily for publication, but as a guarantee of good faith.—Eds.]

Information Wanted.

Peoria Gas-Light Co., Nov. 25, 1869.

Messrs. Editors: Can you work an Exhauster, in an inch to an inch and a half vacuum, even with Compensator, without drawing in some air, or some other thing that will quickly show itself in the illuminating qualities of the gas? Should an Exhauster ever be run below Zero? Will some of our Engineers give us their opinion?

I remain, yours truly,

Inquirer.

Commendatory.

Messrs. Editors: The latest number of your Journal of December 2d, is so admirable, that I feel it to be a duty and a privilege to send you a word of acknowledgment for the pleasure derived from its perusal.

1st. The vexed question of the origin of the Albertite formations is ably treated.

2d. Your description of the new portable gas machine is particularly clear in its statements of the principles upon which this useful class of machines has, heretofore, been operating, and in its detail of the practical difficulties which have beset the numerous inventors who have worked in this field. I know nothing of the new machine, but it appears to have a true starting point, and at any rate its proprietor, or inventor, ought to thank you for your intelligent explanation.

3rd. The article upon photometric calculations must arrest and reward the ttention of all gas experts into whose hands it falls; and it may be said in relation to all that Professor Silliman gives to the press, that his literary ability is worthy of his scientific attainments. It is not every scientist who can thus bring out the results of his patient labors, and lay them before the readers of a popular Journal, in a form, such that its simplicity and directness shall exclude all embarrassment to the unscientific. Careful readers must frequently pause, to admire the peculiar precision and felicity of language in all Prof. S's writings. Those who are so fortunate as to come within the circle of his friends, say that his conversation is both a study and a delight. You have seldom published a more instructive article upon any of the specialties to which your columns are devoted; and the permission accorded to you to publish in *extenso* an article prepared for, and designed to be printed at a later date in another serial, displays a liberality as generous and enlightened as it is creditable to *Silliman's Journal*.

4th. Your account of the new hydrocarbon process is interesting to the general reader, and calculated to set every one connected with gas works to examine his own books and methods of working. If such continuous results have been obtained, and upon so large a scale, the conservatives among us (and we are a con-

servative set, Mr. Editor) will be compelled to open one eye, if not both.

And last, but not least, Professor Wurtz makes your readers his debtors. Long may you retain his able assistance, which has already added so much character and weight to the GAS-LIGHT JOURNAL.

In this world, so given to grumbling and censure, a toiling Editor, it seems to me, may be sometimes a little refreshed by a spontaneous acknowledgment of the success of his professional exertions, and in this view alone, I beg you to accept these few words from a source unknown to you. OLD SUBSCRIBER.

[It is needless for us to assert that the above letter pleases us. It is a spontaneous and graceful tribute to our poor but earnest efforts to please and instruct our readers und patrons, and on that account is all the more grateful to us. It gives us renewed vigor, and encourages us to toil on in the laborieus but desirable paths of Science, wherein we have cast our lot. The writer little knows, probably, how deep an impression his words of commendation and encouragement have made—how like a "perpetual song of gladness" they will cheer and encourage the literary toiler evermore. In these poor words are our thanks.—EDS.]

Recent American Patents.

Pertaining to Gas, Water. Etc.

96,364.—Apparatus for Carburetting and Applying Air for Lighting and Heating.—Joel Tiffany, N. Y.

96,368.—Steam Water Elevator.—James D. Warner, Brooklyn, N. Y.

96,432.—Turbine Water Wheel.—David. O. Holman, Adams, N. Y.

96,441.—Gas Burner.—Wesley L. Jukes (assignor to himself, Frederick McLewee, Prentice H. Putnam, and Bronson Murray), N. Y. City.

96,453.—Water Wheel.—Myron H. Matson, Horseheads, N. Y.

96,775.—Water Wheel.—Denison Chase, Orange, Mass.

96,785.—Water Elevator.—G. W. Dickerson, Prairietown, Ind.

96,842.—Apparatus for Carburetting Air.—Ira W. Shaler, Brooklyn, N. Y.

96,853.—Water Wheel.—Alonzo Warren, Boston, Mass.

96,936.—Composition for Preventing Oxidation of Metallic Water or Gas Pipes.—George Albert Mariner and Folsom Dorsett, Chicago, Ill.

96,952.—Water Wheel.—Phillip O. Palmer, Swoope's Depot, Va.

96,997.—Still for Distilling Naphtha and Petroleum.—A. H. Tait, Jersey City, N. J.

97,017.—Water Elevater.—T. P. Wilcox, Hebron, Ind.

97,051.—Mercurial Gas Regulator for Nitrous Oxide Apparatus.—J. B. Coolidge, Boston, Mass.

97,056.—Steam Engine Governor.—Rollin Defrees, Newark, N. J., assigns to J. D. Defrees, and T. Percival three-fourths of his right. Ante-dated November 19, 1869.

97,085.—Turbine Water Wheel.—A. M. Harding, Oregon City, Oregon.

97,122.—Portable Gas Apparatus and Carburetter.—M. A. Root, Philadelphia, and J. D. Caster, Norristown, Pa.

97,225.—Steam Water Elevator.—W. E. Prall, Washington, D. C.

97,247.—Gas Machine.—Howard Tilden, Boston, Mass.

97,283.—Apparatus for Carburetting Air.—C. F. Dunderdale, N. Y. City.

97,334.—Apparatus for Producing Illuminating Gas.—C. F. Dunderdale, N. Y. City.

97,285.—Gas Machine for Carburetting Air.—H. F. Eberts and John Fanning, Detroit, Mich.; said Eberts assigns his right to said Fanning.

97,311.—Vapor Burner.—J. H. Pattee. Monmouth, Ill. Antedated Nov. 24, 1869.

97,353.—Sectional Steam Generator.—A. S. Cameron, New York City.

97,361.—Automatic Boiler Feeder.—Silas Cook, Magnolia, assignor to himself and Henry Ford, Sioux City, Iowa.

97,372.—Boiler Flue Cleaner.—John Fairclough, St. Joseph, Mo.

97,457.—Apparatus for Generating and Carburetting Illuminating Gas —Amos Stevens, Fitchburg, Mass., assignor to himself and H. C. Mahurin.

REISSUES.

90,644.—Apparatus for Generating and Carbureting Gas.—Dated June 1, 1869; reissue 3,748—Cleveland F. Dunderdale, New York City.

The Sun a Flaming Fire.

The curious insight we are beginning to glean of the highly susceptible and sensitive constitution of the sun, strikes our imagination more and more as new discoveries are made. That a mass but little denser even as a whole than water, nearly four times as light, bulk for bulk, as that of our own earth, and surrounded by an envelope of burning gas, which is by comparison with the intense heat and light of the proper surface of the sun itself mere cold and darkness—that a mere wandering flame of this kind, shooting rapidly tongues of fire on all sides, and so highly susceptible to external influence that certain combinations of planets which, when all thrown into the same scale, would make up only an infinitesimal portion of the sun's mass, cause the most marvelous disturbances in his physical constitution, and lead the magnetic storms on his surface—that such a body as this, we say, should yet for thousands of years exercise so orderly, continuous, and consistent an influence over the development of our terrestrial world and our human affairs, does seem truly marvelous. Can anything be conceived less apparently likly to lead to fixity of tenure in our universe than a center for it such as this—a great boiling furnace of forces enveloped in an atmosphere of flaming gas, and subject to the most violent superficial excitements under the most apparently insignificant external influences? The old Hebrew conception of an earth "founded on the seas and established on the floods," which had been made so fast that it "could not be moved," was a conception of perfect solidity compared to that heliocentric basis of our universe—a hurricane of flame, the disturbances of which might perhaps be best represented to our imaginations by the occasional explosion of a planet or two of nitro-glycerine, which we are compelled to substitute. Yet hence proceed attractions of gravitation which have not sensibly altered during the life of man upon the earth—waves of light indicating by their spectra the burning of the very same substances in the sun as were being consumed in all probability when the words "let light be" were first registered—and, as we now appear like to learn, periodic magnetic impulses, recurring with the punctuality of seasons and eclipses, certain to be full of import for us, and yet not improbably of the same nature as those greater hurricanes by which other suns have perished. Is it possible to conceive a more apparently unstable center and fountain of a universe of law and order? Is it possible to conceive a more impressive lesson on the words, "He maketh his ministers a flaming fire?"—*Harper's Weekly.*

Equity in Patent Cases

We are informed that the following is a draft of a bill which will be introduced into Congress at its next session. Its object is to protect inventors from unjust claims of prior patentees, and force those who claim infringements to bring their causes into court, and test the question with as little delay and damage to the later inventor as possible. Such a law is, we think, called for to protect inventors from unjust claims, damaging statements, and tedious delays which they are now frequently forced to endure. We commend it to the careful consideration of our readers.

BE IT ENACTED *by the Senate and House of Representatives of the United States of America in Congress assembled:* That, whenever any patentee, grantee, or assignee, by virtue of any patent granted in accordance with the provisions of the Patent Laws of the United States, is exercising or using the rights and privileges therein specified, and making the improvements of the same useful to the public, that when any person so interested in a prior and older patent, shall, either by publication or otherwise, notify the public that such person so exercising such right or privilege granted in the later and junior, is infringing the elder and prior patent; such person so interested in the later and junior patent, may, by bill in eqnity, brought in any Circuit Court in the United States, where jurisdiction may be had, set forth the interest of the respective parties in such conflicting patents, requiring the person so interested in the prior patent to show cause why a decree of non-infringement shall not be entered against such elder patentee; and the court before whom any such case may be tried shall grant such decrees, and award such damages as the equities of the case may require, either for infringements or otherwise.

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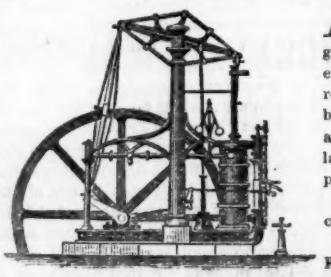

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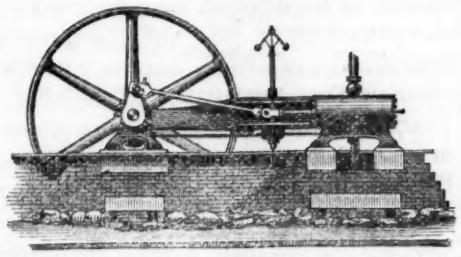

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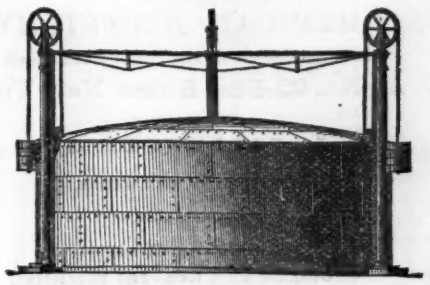

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[NOTE BY PROFESSOR WURTZ.—Contributions and items for which I am, as a Scientist, individually responsible, will have attached my full name or initials.—H. W.]

THURSDAY, DECEMBER 16, 1869.

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We desire to have every one receiving this number of the Journol, see if their subscription is paid for the year, and if not, renew it immediately, so we may keep their names on the New Year list intact. All reciving the Journal for the first time will also please remember that a remittance of $3 will insure them the Journal one year, every number of which will be replete with Scientific, Chemical, Mechanical, and general information, both original and selected, of a nature not to be had in any other publication. In gas matters it is alone, and every GAS CONSUMER, as well as manufacturer, etc., should not fail to have the Journal, and save themselves much time, trouble, and money thereby.

FOREIGN IMPROVEMENTS IN GAS APPARATUS.

In a review of the Report of the Proceedings of the last meeting of the British Association of Gas Managers, held at the Royal Institution at Liverpool, several interesting improvements in the construction and operation of gas apparatus were brought forward, and their merits discussed. Some of these we propose to make brief mention of.

CHARGING AND DRAWING RETORTS BY MACHINERY.—This improvement was invented by Messrs. Best & Holden, and described in a paper read by Mr. George Anderson, of London. The apparatus consists of a steam boiler and engine, mounted on a platform or car, running upon a railway. This engine sets in motion three coke rakes and scoops alternately, designed to draw and charge alternately three vertical retorts at a time. The scoops are filled by mechanical means simultaneously, from a hopper carried on the same framing as the machine. The retorts are so set that the mouths of three retorts form one chamber, with one door and one stand pipe for the three. The action of the machine is described as follows:

The door of three retorts being swung open on its hinges, three rakes are run into the three retorts. These rakes are each provided with a jointed hoe at their point; when the rakes have reached their full distance into the retorts the hoes are made to fall down, when a reverse action is given to them, which brings the whole charge out at one haul. The machine is now traversed about three feet, which brings the scoops already filled, opposite the retorts; they are run in tilted, and withdrawn. The machine is further traversed about three feet, the door is swung to, having been brushed on the inner face with a little melted grease, and closed by driving up two wedged-shaped legs and the process is finished, occupying about three minutes. Each machine requires four men to work it. The cost of working these machines at the Alliance Company's new works at Dublin, was at a cost of, it is said, £9 1s. per week. each machine charging 171 retorts. The machine draws and charges 9 retorts in nine minutes. The cost of raising all the coal fifteen feet in the first instance, to the feeding hopper of the machine—the fuel for the steam boiler—oil and cotton waste—wear and tear, and maintenance of machine, all are items not taken in the above estimate, and will doubtless materially modify the actual cost in practice.

DUNBAR & NICHOLSON'S MACHINES FOR CHARGING AND DRAWING RETORTS.—This invention is intended to charge one retort at a time. It receives its steam from a pipe leading from a stationary boiler. The scoops come to a level with the floor, and are filled by hand. This machine is suspended from girders overhead, and the whole of the machinery moves backwards and forwards in doing its work. The scoops for feeding the coal into the retorts contain also the rakes for withdrawing the coke at the end of the charge. When the coke is to be withdrawn the scoop inverted is inserted. The rakes or hoes are disposed in the scoop at intervals, and press down and cuts the coke in sections to facilitate its removal. The scoop is elevated and depressed by wheel gearing, and the entire machinery overhead is arranged to traverse on elevated rails, parallel with the face of the benches. It is said this machine will charge a retort in four seconds, the filling of the scoop by hand taking the usual time. These machines cost £250.

SUBSTITITE FOR HYDRAULIC MAIN.—Mr. Esson read a paper before the Association in which, after stating the advantages of removing the seal of the dip-pipes in the hydraulic main, he describes a form of throttle-valve and connection which has been on trial, and found free from objections to other substitutes for the seal heretofore tried.

The valve consists of two pieces, the chamber and stopper. It is opened and shut by means of a lever moving a central rod working the stopper through a stuffing box. The lever forms a cross on the end of the stopper spindle, having on one end a small cast-iron ball, and on the other end an iron rod reaching down to the stoker. The rod on being pulled and kept down opens the valve, and on being loosened ascends by the gravity of the iron ball on the other end of the lever, and so shuts, and keeps shut the valve. The valve is inserted between two flanges forward to receive it on the pipe from the retort. When the retort is at work the iron rod is pulled down and hooked into a catch, attached generally to the retort-lid. The rod, when the retort is to be drawn and again to be charged. is unhooked, and the counter-balance overbalances the lever and shuts off the gas.

The advantage of some such contrivance is well understood by gas men. The absence of pressure in the retorts reduces the fuel account, increases the yield, makes richer gas, lessens the deposition of gas carbon, and lessens wear and tear; items of no small importance in the study of economy in gas manufacture.

It is fair to estimate the gain, or saving more properly speaking, to be obtained by an invention of this nature that will be simple, practical and effective, to be equal to from 10 to 15 per cent. We look forward to the adoption of something of the kind as a coming event in a short time, by all prominent gas managers.

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We take pleasure in calling the attention of our readers, and especially gas men, to the Providence Steam and Gas Pipe Company, whose advertisement will be found in another column. It is an old established and well known firm, having been twenty years in operation, building steam heating and gas works, etc. The company have built in all some seventy works for coal and rosin gas, for both town and manufactories. They have competent engineers and experienced workmen, and are about increasing their facilities, in view of the coming business season.

☞ The *Journal of Applied Chemistry*, for December, comes to us with a leading and valuable article by Professor Joy, on chloral, the new therapeutic agent of Liebreich, which is now exciting so much interest. We commend it to our readers (Prof. J.'s article, not the chloral; as we don't know whether they could get the latter pure and safe just yet). In our late French Journals we find abundant evidence that the hopes held as to this new nervous stimulant, are very likely to be justified. Dumas thinks that the great field of organic compounds will yet furnish us with multitudes of equally valuable medical discoveries.—H. W.

Foreign Gas Matters.—Mr. John Arnott, Gas Consulting Engineer, Leeds, England, has kindly furnished us with a copy of the Report and Rules of the last meeting of the Gas Managers' Association in Liverpool, of which association he is a member; also the late Report of the Proceedings of the British Association of Gas Managers, for which we are greatly obliged. Mr. Arnott is a gentleman well known to the public as a practical gas engineer of experience and sound judgment, who keeps well up with the progressive spirit of the times.

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☞ The following notice we find in a Chillicothe Journal, Onio, the residence of Mr. J. W. Graham, the inventor of the improved Anti-freezing Lamp Post for streets, etc. The patent was obtained for Mr. Graham by this office, and it is a satisfaction to know that it is, as we predicted, a great success.

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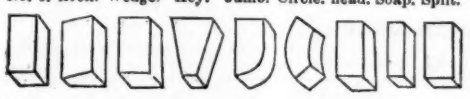

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The proposals, addressed to the undersigned, must be sealed and endorsed "Proposals for Coal Tar." They must state the offer for the Tar at a price for each ton of Coal carbonized at the Works of the Company. The quantity of Coal carbonized per annum is about 140,000 tons, and the average yield of Tar per ton of Coal is about 12 gallons. The Company do not bind themselves to accept the offer of the lowest, or any bidder.

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JOSEPH A. SABBATON,
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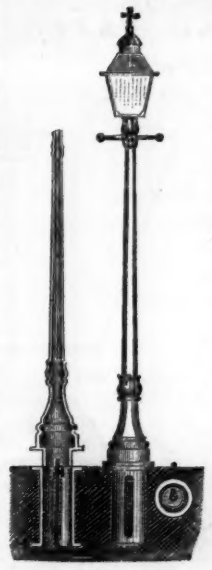
TO THE WORKING CLASS.—We are now prepared to furnish all classes with constant employment at home, the whole of the time for spare moments. Business new, light and profitable. Person of either sex easily earn from 50c. to $5 per evening, and a proportional sum by devoting their whole time to the business. Boys and Girls earn nearly as much as men. That all who see this notice may send their address, and test the business, we make this unparalled offer: To such as are not satisfied, we will send $1 to pay for the trouble of writing. Full particulars, a valuable sample, which will do to commence work on, and a copy of *The People's Literary Companion*—one of the largest and best family newspapers published—all sent free by mail. Reader, if you want permanent, profitable work, address E. C. ALLEN & CO., Augusta, Maine. 237

BRANSON'S PATENT LAMP POST.

THE ADVANTAGES OF THIS PATENT POST over the old style, are as follows:



1st. The saving of the base or bottom part of the Post, when the column is broken, the Post being made in two parts. The broken column can be replaced by a new one, without disturbing the base.

2d. When the old style of post is broken, the bottom piece has to be dug out, which cannot be done in winter, or in wet weather: all this is obviated in this Post, as no digging is required. This style of Post is especially desirable when flag stone sidewalks are used.

3rd. When a stoppage of gas in stand pipe occurs, the column can be lifted out, the pipe detached, cleaned, and replaced in fifteen minutes; no digging being required as is now done with the old Post.

4th. A lighter and better casting can be made from this patent, and it can be handled better, owing to its length and lightness.

5th. In case a broken column cannot be repaired, one third of the original cost is saved by the base being secured and perfect.

Rights for States, or the United States, on reasonable terms. Address, Editors Gas-Light Journal, 22 Pine street, N. Y.

Certificate.

St. Louis, September 1, 1869.

I have examined a new Lamp Post, the Branson patent, and unhesitatingly pronounce it to be the best thing of the kind I have ever seen. Posts of this description have been erected in this city, and in my opinion this style of Post should be universally adopted, as I believe it possesses all the advantages claimed for it.

THOMAS PRATT,
587-6m Sup. St. Louis Gas Works.

DUNBAR'S
Gas Retort Setter's Guide,

Or how to set a Bench of Betorts, 14 x 22, 8 feet 7 inches long, that may be worked up to a capacity of 7000 feet per Retort in 24 hours, with the various sizes of Retorts, producing the like results, or 6,500 feet per Retort a day, on an average, for six months.

With specific instructions how to successively manage the same, so as to obtain like results for six and twelve months more, thereby creating a great saving in capital and labor. Also, instructions how to burn your own Lime in a vacant oven.

Having 18 year's practical experience in Retort room, and management of Gas Works, I feel that I have attained that proficiency which will enable me to make the Work of great value to the profession.

The Work will be published as soon as 100 subscribers are received. Subscription price $5.

All desiring a copy of this valuable Work, are requested to send their names to the office of this Journal. 236-3m

CHEAP PAINTING.—
1/8 COST LEAD. { 100 lbs of the Pecora Company's Colored Paint (costing $12.50) will paint as much as 250 lbs. of Lead, and wear longer. For particulars, address S. BOWEN, Sec'y., No. 150 N. Fourth St., Philada.

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[Extract from Testimonial from Merrick & Sons' Southwark Foundry, Philadelphia.]

"Mr. S. Bowen, Secretary Pecora Lead Company:—Your Metalic Cement is better than red or white lead for making Steam Joints, or patching. Hot rivets do not effect the Cement; we use it in joints of light tanks, in the place of caulking, and they do not leak. We use it also on gas-holders.

J. J. GREENFIELD,
" Foreman of Boiler Department.

[Extract from testimony from Suprintendent Chelsea Gas Co., Mass.]

"We are much pleased with the Pecora Paint, it is just what Gas Company's want, it dries while the water is running down the holders; and we would not hesitate to have them settle immediately.

"The Pecora Co's Steel Color is remarkable for the beauty and finish given to machinery and all iron work, giving a finish superior to any paint yet introduced, and used by Wm. Sellers & Co. Merrick & Son's, and others."

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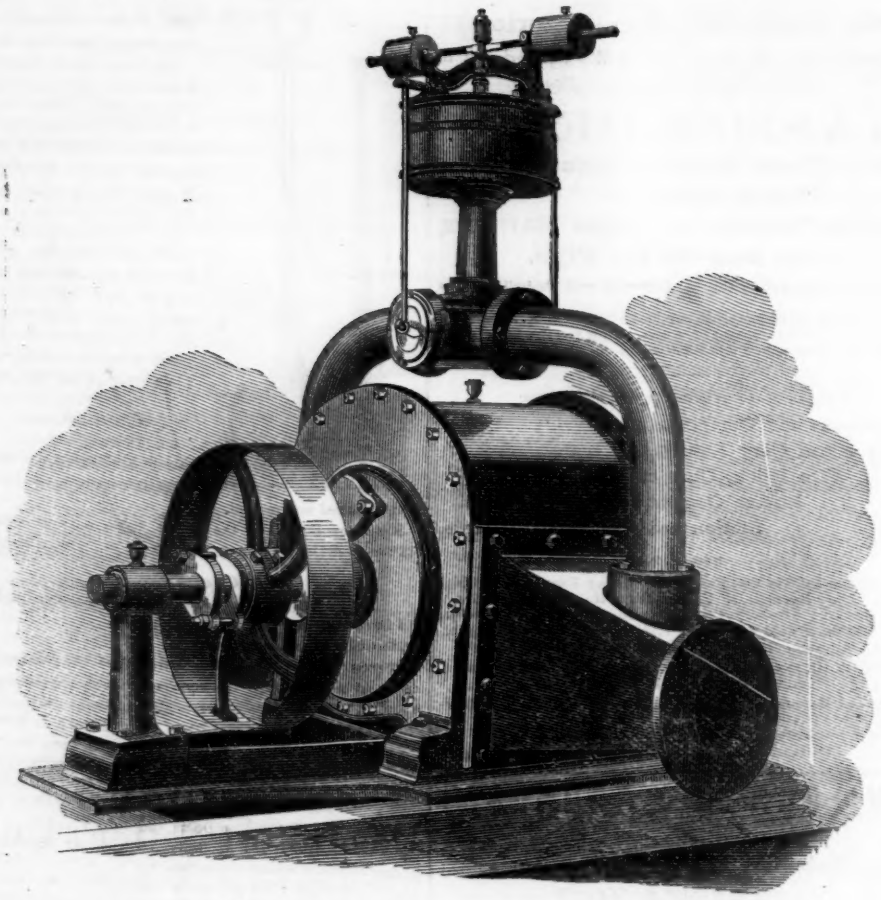
Smith & Sayre Manufacturing Company.

The Maokenzie Patent Gas Exhauster, AND PATENT COMPENSATOR.



They are made to pass from 4,000 to 150,000 cubic feet of gas per hour; will increase the production and illuminating power of the gas, and add very much to the durability of the retorts, eitheclay or iron. The Compensator obviates entirely the necessity of water-joints, is compact, durable cleanly, not liable to get out of order, self-acting, quiet, and certain in its operation.

We are also sole proprietors and manufacturers of the

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The Blower is a Force Blast machine, durably built, and can be driven with one-third the power required to drive the ordinary Fan. The Cupolas are manufactured in sizes to melt from 1 ton to 20 tons per hour, will save one quarter of the time required by the old style Cupola, and 33 per cent. fuel. Address

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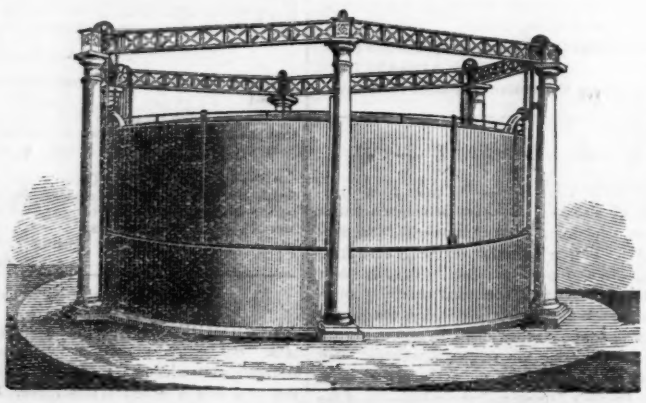

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Particular attention paid to Alterations and Repairs.

LUDLOW VALVE MF'G CO

OFFICE 193 RIVER ST., TROY, N. Y.

Make Valves ¼-inch to 24 inch, for Water, Steam & Gas.

FIG. 1.

Fig. 1 shows a single gate valve.

Fig. 2 represents wedge and one-half of gate.

Fig. 3, a section through body, gate and wedge, intended for larger sizes of water valves required to bear heavy pressure either side.

The slides, G G, are held against wedge D, by ribs, H H, projecting from sides of valve body, A.

In closing the valves, when opening I is covered, slides, G G, pass the lower ends of ribs, H H, when the wedge, D, can move forward on the inclined planes E E, and crowd the gates apart.

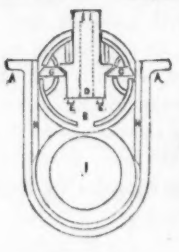


FIG. 3.

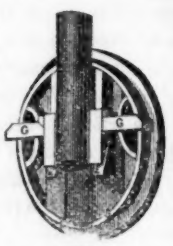


FIG. 2.

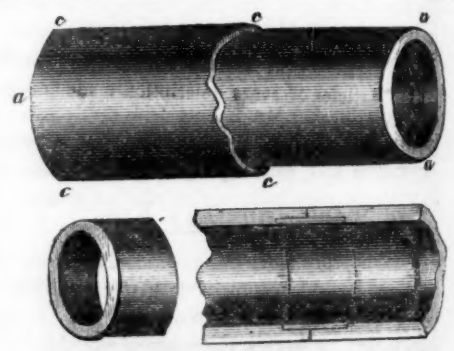
[From A. F. Havens, Engineer Brooklyn Gas-Light Co.]

"I take great pleasure in saying that they give perfect satisfaction—opening easily and quickly, and requiring no effort to start them, even after they have been closed for months.'

[From R. E. Roberts, Secretary Detroit Water Works.]

"Commenced using your valves in 1866; have over 200 in use: have given satisfaction."

☞ { More than 80 Gas and Water Companies have them. Send for Descriptive Circular.



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These Pipes combine

Strength, Durability, and Economy.

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Wyckoff's Patent Gas Pipe is less expensive than other kinds, more serviceable and more durable; being coated, inside and outside, with imperishable material, and impervious to air, gas or water, and warranted to give satisfaction. 219tf

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AN INDESTRUCTIBLE COATING FOR

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It has much more body than red or white lead. It is warranted perfectly water and fire-proof and to withstand a greater heat on metals, without scaling, than any other paint in use.

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Terms, by the Barr elor Half Barrel, Five Cents per Pound.

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A Barrel or Ton will be forwarded to any gas companies desirous of testing its qualities, for which there will be no charge if it does not give entire satisfaction as being the cheapest and most durable of all other Paints in the market.

Also, Prince's Imperial Black Paint, and Prince's Protoxide of Iron.

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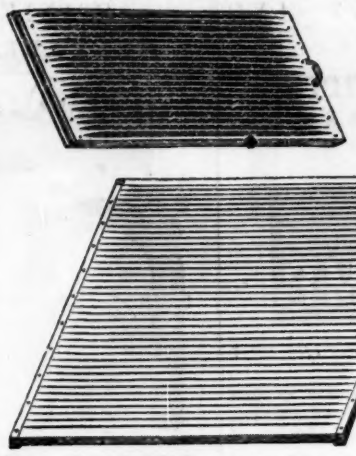

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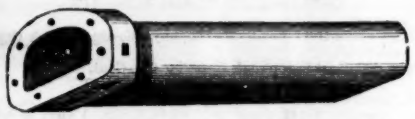

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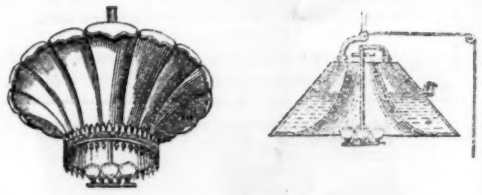

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PATENT LAMP POST.---THIS INVENTION relates to constructing Lamp Posts in two parts, viz. A base which is set in the ground, and a column or upper part which fits into the upper end of the base. By making Lamp Posts in this manner a great saving may be made in the original cost of the post, and in case the upper part of the post is broken, it is easily replaced by a new one, without the trouble and expense of digging up the old base, which frequently has to be delayed from inclemency of the weather. There is a collar around the upper end of the base, on which the base of the upper part rests. The sleeve has a number of lugs or chipping pieces projecting from its sides, which can, in a few minutes, be chipped off sufficiently to let the sleeve fit the base, no other tools being required but a hammer and chisel. In case the upper part of the post is broken so that it cannot be repaired the base is saved, which is one-third the cost of the post. In case the gas pipes become stopped by freezing or any other cause, the column can be lifted out from the base, the gas pipe (or stand-pipe) detached, the obstruction removed, and all put up in good order in the space of twenty or thirty minutes, which is a great advantage over the old posts. A cock can be put on the upper end of the bend of the gas pipe, and in case of breakage can be turned so as to shut off the gas. This is also no small item, and cannot be done with the old post. A stronger, lighter, and better casting can be made, and at the same time more sure to turn out better than the old posts.

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OIL TUBING, CAST IRON DRIVING PIPE,

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Fitted with our improvements for oil, and specially adapted for suburban residences which have been or are to be piped for Gas, but to which the mains have not yet rea hed, and oil is to be used temporarily, or they can be used elsewhere as well.

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Mr. Joseph Shackelton has just completed an arrangement by which we are enabled to apply the exhaust steam from our engine for the purpose of heating water used for dyeing, felting, scouring and other purposes. We have made a careful test of the amount of fuel saved by the use of this arrangement, and find it to be from forty to fifty per centum. MOORE & SEELY BROS.

Newark. N. J., December 18, 1868.

Mr. Joseph Shackelton—Sir: This is to certify that I am using your system of using the exhaust steam from my engine. It has been in operation for three months, and works satisfactory in all respects. I find a saving of coal of about 50 per cent. JOS. GUILAM.

We have used Mr. Shackelton's patent system of heating our kettles and factory by exhaust steam for seven months We find that there is a saving of coal of about 50 per cent.

218tf YATES, WHARTON & CO.

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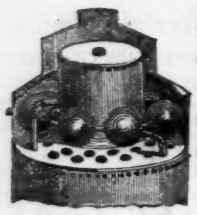

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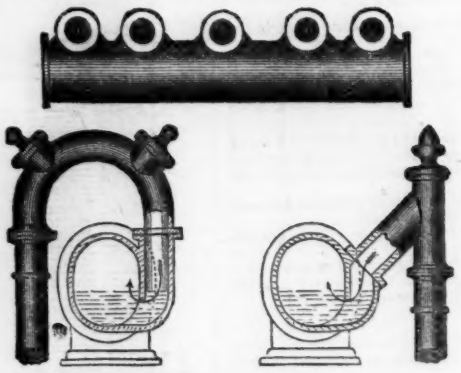

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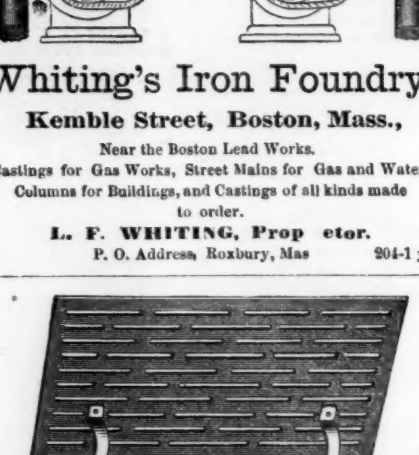

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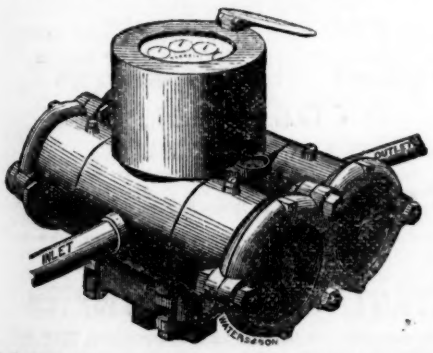

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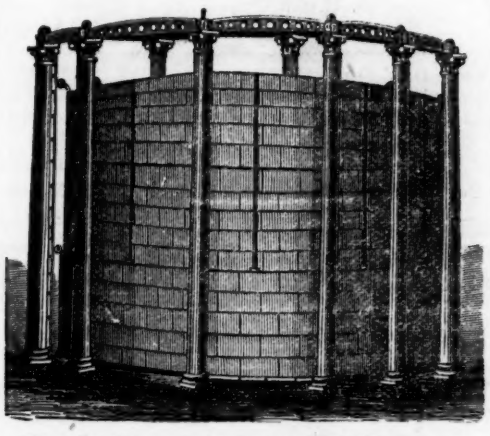

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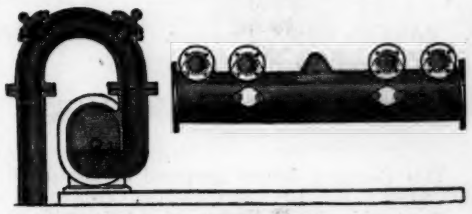

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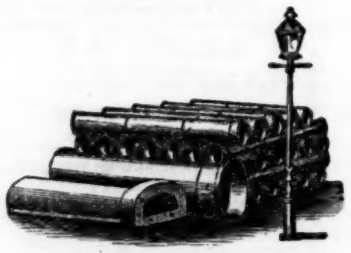

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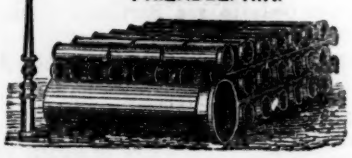

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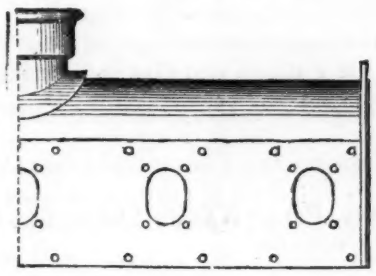

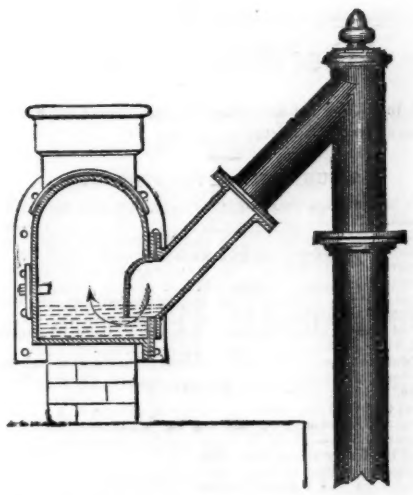

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